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With the initiation of the Yuma project for irrigation of the areas contiguous to the river in and around the head of the delta, a movement has begun which will make the alluvial lands a home of many thousands. The work of converting the delta to the uses of civilization will be hindered by the fact that some of the main drainage channels cross and then recross an international boundary; but doubtless in a comparatively brief period the agricultural aspect of the entire area will approach that of the Nile, which has supported a teeming population for centuries.

TOPOGRAPHIC SURVEYS OF THE UNITED STATES IN 1905.

During the season of 1905 topographic mapping was continued with vigour in the eastern portion of the United States. In Maine the U. S. Geological Survey, in co-operation with the State Survey, completed the mapping of an area of about 220 square miles on the upper Kennebec River, in Somerset County. The scale of this work was one mile to one inch, and the relief is shown in contours of twenty-foot interval. This region is just below Moosehead Lake, and has been lumbered over extensively in past years. It has been overgrown in recent years with second growth, is practically impenetrable by roads or paths, and abounds in game, including large numbers of grouse and deer and some moose. The map of this region will be of great value to lumbermen and to engineers, some of whom are now engaged in extending the Somerset County Railroad north from Bingham. Incidentally, the Hydrographic Branch of the Geological Survey made detailed surveys of Moosehead Lake and of the Moose River and the lakes along it, including Brasson and Long Pond. These latter investigations are made to determine the storage capacity of this region for supplementing the flow of the river for the production of water-power.

Very little progress was made in the topographic mapping of New York as compared with previous years, because of the failure of the Governor to approve the bill which had passed the State Legislature for continuing the topographic survey of the State in co-operation with the United States Geological Survey. Accordingly, after plans had been perfected for pushing the survey of the State to completion, the parties had to be withdrawn, and only a little work was done to close up some partially-mapped areas. This included about 900 square miles mapped near Loon

Lake in the Adirondacks, about Port Leyden and near Sangerfield and Winfield in Madison and Herkimer Counties.

In Pennsylvania, in co-operation with the State Survey Commission, an area of about 1,200 square miles was mapped on a scale of one mile to one inch and in twenty-foot contours. This will be represented upon six atlas sheets—one north of New Castle in Lawrence County, one west of Washington, one each northwest and southwest of Harrisburg, one south of Reading, and one near Clarion. The progress made in mapping Pennsylvania, while satisfactory, was not as rapid as it should be for the completion of the survey of such an important State. There remain yet practically unsurveyed thousands of square miles in the central and northwestern parts of the State, which are its roughest portions.

In Maryland an area of about 300 square miles was mapped in detail on the scale of one mile to one inch and with twenty-foot contours. This work was done in co-operation with the State Geologist. This was chiefly re-surveys of old reconnaissance maps made south and west of Baltimore in the neighbourhood of Relay and Laurel. The survey of the entire Eastern Shore of Maryland has been completed, and there remains only a small area of the State, chiefly in Montgomery, Frederick, and Washington Counties, yet to be mapped.

In West Virginia better progress was made than usual in topographic surveying, an area of about 1,100 square miles having been completely mapped on a scale of one mile to one inch and with twenty-foot contours. At the request of the State Geologist, in co-operation with whom this work was carried on, this was in the neighbourhood of Kingwood, Thornton, Belington, and Parsons, in the northeastern corner of the State, and near Arnoldsburg, Spencer, and Ripley, in the western part near the Ohio River. All of these sheets have great value in connection with the development of railways which are being rapidly built in this region and of the wonderful gas and coal resources.

In Virginia an area of 220 square miles was mapped about Yorktown and Jamestown because of the interest in the approaching Jamestown Exposition. Topographic mapping was commenced also, on a scale of one mile to one inch, over the region about Natural Bridge and Buchanan.

In North Carolina, in co-operation with the State Agricultural Department, three sheets of 225 square miles each were completely mapped—one a little west of Elizabeth, one in Sampson County south of Smithfield, and one about Charlotte. In South

Carolina about 600 square miles were mapped, a portion of the area being northwest of Chester near Yorkville and the remainder immediately northwest of Spartanburg. These various areas were selected because of the interest in the neighbourhood of Charlotte and in the eastern part of North Carolina in the movement for the improvement of roads, and in South Carolina because of the valuable mineral resources being developed in that area. In western North Carolina an area of 1,000 square miles, covered by the old reconnaissance Cowee sheet, was re-surveyed in detail, and will be of service for the further development of the valuable deposits of precious earths, including zircon and monozite and the gem hiddenite, for which this region is justly famed.

In Georgia a small area was surveyed in detail on the scale of 2,000 feet to one inch about Dahlonega, for the more intimate study of the gold resources of that region, which is the best gold-producing area in the eastern part of the United States. In western Georgia an area of 1,300 square miles was surveyed on a scale of two miles to one inch, with contours of fifty-foot intervals, immediately north of Columbus and extending to the Chattahoochee River and the Alabama State line. Here also some important mineral developments are in progress.

In Alabama, and with a view to more detailed study of the iron deposits about Birmingham, detailed surveys were completed of an area of about 400 square miles about Bessemer and Birmingham, the scale of the work being about one mile to one inch and with contours of twenty-foot interval. In addition a large-scale detailed map of the urban district including the cities of Bessemer and Birmingham was completed on the scale of 2,000 feet to one inch. In Mississippi and Alabama surveying is now in progress on the scale of one mile to one inch. In Mississippi an area of about 500 square miles will be completed about Jackson, and in Louisiana an area of equal amount about Baton Rouge.

In Kentucky, in co-operation with the State, an area of about 450 square miles was surveyed on the scale of one mile to one inch about Frankfort and Versailles and near Louisville. In addition a large detailed city map was made of the urban district about Louisville, including New Albany and Jeffersonville, Indiana, on the scale of 2,000 feet to one inch.

Unusually good progress was made in topographic mapping in Ohio, in co-operation with the State. An area of 3,700 square miles was completely mapped. This covers portions of eighteen atlas sheets distributed throughout various parts of the State. The larger groups are included in five sheets mapped in the northeastern corner of the State, three southwest of Cleveland and New Manchester, two in the southeastern corner along the Ohio River, and several in the western portion of the State near the Indiana border. In addition a large amount of primary control and spirit-levels was extended to prepare for the future mapping of the unsurveyed areas.

In Illinois six sheets of about 220 square miles each were mapped in co-operation with the newly-created State Geological Survey. All are on the scale of one mile to one inch. Two about Champaign and Urbana, with contour intervals of ten feet; one near Springfield, one east of St. Louis, and two near Eldorado, in the southeastern corner of the State, were mapped with twenty-foot contours. The latter sheets cover areas of much interest to the geologists in connection with the study of the valuable coal deposits of those portions of Illinois.

In Michigan a fair start was made in topographic mapping in co-operation with the State Geological Survey. The Marquette sheet was completed in much detail, and will be of value in the study of the celebrated Marquette Iron Range. North of Detroit preliminary surveys were made over quite an area between Pontiac and Howell.

In Wisconsin topographic mapping was completed over an area of 220 square miles east of Madison, and preliminary surveys were completed over a similar area immediately east of La Crosse, in Monroe County.

In Minnesota an area of 220 square miles was mapped on the scale of one mile to the inch, including Lake Minnetonka, an important summer resort region immediately west of Minneapolis.

In North Dakota an area of 1,000 square miles was mapped on the scale of two miles to the inch and with contours of fifty-foot interval in the neighbourhood of Bismarck. The resulting maps are of importance in connection with the development of the extensive lignite deposits found along the Missouri River in this region and in connection with the reclamation of valuable lands along the Missouri bottoms.

In Iowa an area of about 225 square miles was mapped on the scale of one mile to one inch about Des Moines, and will be used by the State and Federal geologists in studying the coal deposits in that region.

In Nebraska an equal area was mapped on the same scale about Nebraska City, on the Mississippi River south of Omaha.

In Missouri an area of 1,000 square miles was mapped on the scale of two miles to one inch immediately south of Springfield and between Ozark and the Arkansas State line. In the northeastern portion of the State between Macon and Shelbyville preliminary mapping on the mile scale was in progress with a view to the completion next year of the survey of an area of about 1,000 square miles.

In the western or arid portion of the United States the topographic mapping was pushed vigorously in nearly every State. In the course of this work some interesting local facts were developed, as the depth of the Salton Sink in southern California and the conditions arising from the filling of the Sink from the break made in the banks of the Colorado River. The survey of Death Valley, Nevada, brought up some new information concerning the depth of this valley below the sea-level, as well as some interesting facts regarding the Amargosa Valley and the Ralston Desert. The region about Mt. Whitney was mapped and the exact height of that mountain determined by spirit-level. New and large-scale surveys were made of the Yellowstone National Park and of the Grand Cañon, Colorado, near the railroad to Bright Angel, both of which result in some of the most remarkable and interesting topographic maps ever produced. An interesting phenomenon developed was the movement of benchmarks, some nearly as much as one foot in elevation, in the southern portion of the San Joaquin Valley, California, probably by earthquakes.

In the extreme northwestern portion of the State of Washington, along the Canadian boundary and Puget Sound, an area of 250 square miles was surveyed in Whatcom County. The scale of this mapping was one mile to the inch, and it covers a region which is found to be quite arid, and is, in fact, the most westerly as well as the most northerly arid region in the United States, exclusive of Alaska. Primary triangulation for the control of future mapping in this region was extended from the Sound eastward, near the Canadian boundary, across the Nooksak River to Mt. Baker. This peak, the elevation of which is 10,827 feet, is one of the most picturesque and beautiful volcanic cones in North America. Its aspect is particularly attractive as seen from the Sound between Port Angeles and Victoria. In eastern Washington an area of 250 square miles was surveyed on the scale of two miles to one inch, near Colfax, which is one of the most important wheat and grain regions in the northwest.

In Malheur County, Oregon, east of the celebrated Modoc lava-bed country, an area of 700 square miles was mapped on a scale of two miles to one inch, including the rich Owyhee and Malheur Rivers. In southwestern Oregon an area of about 900 square miles was mapped on the scale of two miles to one inch in the neighbourhood of Grant's Pass, which is on the short line between California and Oregon and a little north of Mt. Shasta.

In California primary triangulation and levels were extended over portions of Trinity and Siskiyou Counties for the control of future topographic mapping. This includes the region in which Mt. Shasta occurs, and covers the head waters of the Trinity, Salmon, and Klamath Rivers. Topographic mapping on the large scale of two inches to one mile was extended over about 500 square miles of northern Sacramento Valley, in Colusa and Yolo Counties. This work will serve as a basis upon which to study projects for the reclamation of rich agricultural lands of this region. In San Joaquin and Alameda Counties, in the lower part of San Joaquin Valley, an area of about 500 square miles was mapped on the scale of one mile to one inch. This region is immediately southeast of San Francisco, and is highly settled and cultivated.

The valley of Yosemite Park has been mapped on the specially large scale of 2,000 feet to one inch, with contours of fifty-foot interval. This map covers about 40 square miles, and develops in a most remarkable manner the topography of this extremely interesting region, showing up as it does the details of the almost perpendicular rock walls which surround the valley. Near this region and east of the Big Trees Grove, in Tuolumne County, an area of 250 square miles was mapped on the scale of two miles to one inch. Included within this area is the new Stanislaus Forest Reserve.

About Mt. Whitney an area of 1,800 square miles was mapped, and will be published in two atlas sheets. These maps include Mt. Whitney, the highest peak in the United States outside of Alaska, the elevation of which is now known to exceed Mt. Rainier. The height of Mt. Whitney was obtained by means of a line of precise levels which was checked to the very summit of the peak, and the elevation was determined as approximately 14,500 feet. This is subject to computations now in progress to reduce it more accurately through connecting levels to mean sea-level, which may change it from 4 to 5 feet at the most. Mt. Whitney has been supposed to be an unusually difficult peak to climb; yet the topographers found an easy route by which no difficulty was experienced in running levels and carrying instruments and camp equipment to the very summit.

In the eastern portion of San Diego County, near the Mexican boundary line, west of Yuma, an area of 600 square miles was mapped on the scale of two miles to one inch. This area includes the celebrated Salton Sink, in which is located the new city of Imperial, containing several thousand inhabitants and some handsome building blocks, residences, etc. The Imperial Canal Company, which is interested in the irrigation of this area and is incorporated in Mexico, is composed mostly of American citizens. This company opened the banks of the Colorado River in Mexico, and dug a wide canal to conduct the water into the margin of Salton Sink for its irrigation. Recently, the Colorado River began to erode the sandy margin of the canal, and enlarged it so rapidly that now the whole volume of the Colorado River flows through the opening and into the Salton Sink, which is fast filling. This seriously menaces the homes and property of nearly 8,000 people, residents of the United States, and has caused the submerging and reconstruction of many miles of the Southern Pacific Railroad. A serious problem now confronts the people living in this region, to devise some means whereby the Colorado River may be turned again into its original channel and caused to flow into the Gulf of California instead of into the Salton Sink. The lowest point of the Salton Sink is 275 feet below sea-level, and the mapping of the region is of great engineering and economic importance.

A reconnaissance survey, mapped on a scale of four miles to one inch, and with a contour interval of 100 feet, was extended over an area of 10,000 square miles in California and Nevada, covering the region extending south from the important mining developments about Tonopah and Gold Fields. This will be of interest in connection with geologic studies made of this region to develop the trend of the rich gold deposits being discovered. A special map was made of the mining development about the new Eldorado at Gold Fields and Bull Frog, the scale of the maps being 2,000 feet to one inch, and the study of the geology of these localities is about to be undertaken.

In Arizona the surveys commenced a year ago near Bright Angel, in the Grand Cañon of the Colorado, were extended westward, and covered the Shinumo sheet, an area of 250 square miles being mapped on the large scale of 4,000 feet to one inch, with a contour interval of 50 feet. This sheet and the Bright Angel and Vishnu sheets, which were mapped during previous seasons, contain some of the most interesting and intricate topographic forms ever mapped. Depths of thousands of feet are shown in such detail as fifty-foot contours will permit. The first of these sheets to be published will be the Bright Angel, the engraving of which is nearly completed, and will be soon available to the public. Thousands of persons visit this remarkable region each year. In southern Arizona a special map on the large scale of 2,000 feet to one inch was made, covering an area of 40 square miles about Tombstone. This is to serve as a basis upon which to study with greater detail the economic geology of this important region.

A portion of the Uinta Indian reservation in Utah, covering about 300 square miles, was mapped on a scale of 2 miles to one inch. This reservation has been recently opened up for settlement, and the resulting maps will be valuable in connection with its development, which will now go on at a rapid pace. This map also covers the Uinta Forest Reserve. In the southwestern portion of Utah, in Beaver County, a special map has been made of an area of 225 square miles on a scale of one mile to one inch. In the extreme southwestern Utah an area of 200 square miles was mapped east of St. George, in Iron County, on the scale of one mile to one inch, with a view to the future study of the economic resources of the new iron ore body recently discovered in the vicinity of Iron Springs. This entire region, from central Utah southwestward through Nevada to southern California, is destined to see a remarkable change within a few years as a result of the new Los Angeles, San Pedro and Salt Lake Railway, which completes an additional transcontinental connection to the coast. From Salt Lake City this railway runs through the most arid and least-known portion of the United States. It skirts Death Valley, running near the celebrated borax deposits of the Amargosa Valley and extensive gypsum deposits near the bend of the Colorado in the neighbourhood of the Las Vegas. As this region has recently seen some finds of rich gold-bearing quartz and other precious metals, it is doubtless destined to be the scene of the discovery of additional deposits of the precious metal.

In the neighbourhood of Boulder and Greeley, Colorado, about Fort Collins, about 400 square miles were mapped on the scale of one mile to one inch. This region is especially important now, in view of the reclamation projects which are destined to develop its agricultural resources to even a greater extent than heretofore.

In southwest Colorado the San Cristobal sheet, covering an area of 900 square miles, was mapped on the scale of two miles to one inch. This is immediately south of the celebrated gold region of Creede and between it and Silverton, and the map of this country will aid in the study of the resources of a district which promises to afford important mineral development.

A belt of primary triangulation was extended through the Priest River Forest Reserve in northern Idaho, and will be followed shortly by detailed topographic mapping of this Reserve. Near Lake Pend Oreille a portion of the Cataldo quadrangle, covering an area of about 250 square miles, was mapped on the scale of two miles to one inch. This is also a promising region for future mineral development, lying as it does northwest of the Cœur D'Alene district.

The Yellowstone Forest Reserve has been partially mapped during the past season. Nine hundred square miles of its area lying outside of the Yellowstone Park were mapped on the scale of two miles to one inch. This area includes Younts Peak, one of the highest mountains in this region, and a rival of the celebrated Tetons near Jackson Lake. In Carbon County, Wyoming, an area of 400 square miles, covering a portion of the Medicine Bow sheet, was mapped on a scale of two miles to one inch. In addition, primary triangulation was extended over portions of Fremont and Uinta Counties, over the extremely elevated region along the headwaters of the John Day, Green, and Wild Rivers. In this area is the head of the Snake River, which flows into the Columbia and thence into Puget Sound; the Green, which flows into the Colorado and thence into the Gulf of California, and the Platte and Big Horn Rivers, which flow into the Missouri and thence into the Gulf of Mexico.

In South Dakota topographic surveying was continued in the Belle Fourche region, and the survey of Belle Fourche and Indian sheets was nearly completed. These cover 350 square miles on a scale of one mile to one inch, and are important in connection with the development of the irrigation projects now in course of construction by the Reclamation Service, and which will make available for settlement thousands of acres of valuable agricultural land.

In western Texas the Van Horn sheet is now being mapped. By the close of the season an area of 1,000 square miles will have been surveyed on the scale of two miles to one inch. In eastern Texas the Texarkana sheet will be mapped on a scale of two miles to one inch, and it is expected that about 1,000 square miles will be completed in that area during the season.

In connection with delimiting the boundaries of the National Forest Reserves, extensive work was done on the Chiricahua Reservation in Arizona, the entire boundary of which was surveyed and marked with substantial monuments. The boundaries of the Yellowstone National Park were run out in part and carefully marked. In southern California the greater part of the boundaries of the Santa Barbara Reservation were run out and monumented.